Small Business Innovation Research/Small Business Tech Transfer

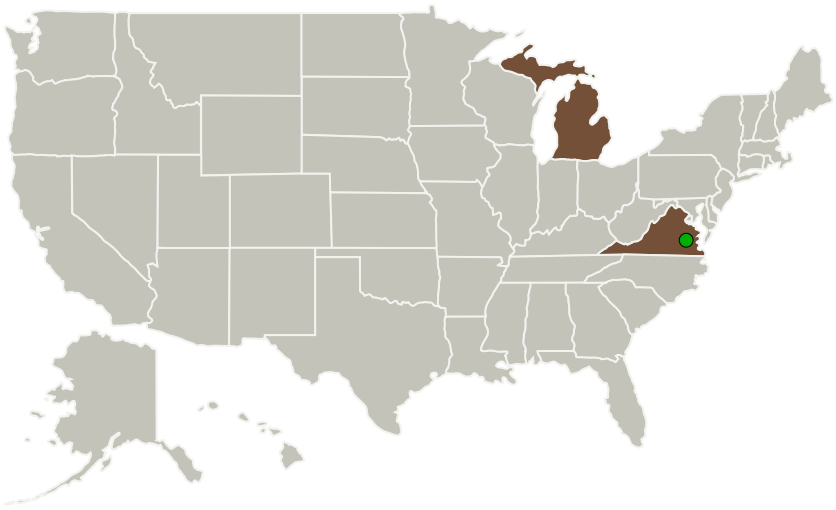
Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase I

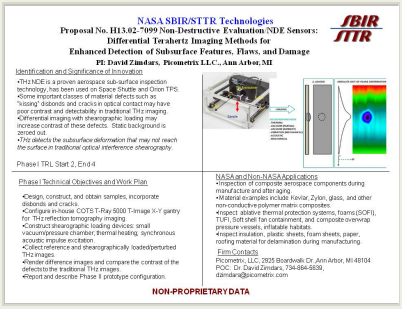
Completed Technology Project (2016 - 2016)

Project Introduction

Picometrix proposes to demonstrate the feasibility of using differential time domain terahertz imaging methods to enhance the contrast and detectability of features such as kissing disbonds and cracks that in conventional THz imaging only weakly reflect or scatter the THz pulses. The goal of the project is to develop methods of shearographic loading of the samples, and use the penetrating THz pulses to detect the subsurface deformation of the defects in the differential THz images with better contrast than traditional THz imaging. In a "kissing" disbond there is a region where the two sides of the material are not adhered, but the space between the two sides are essentially in perfect optical contact. When the space between the two interfaces is so optically "thin," the reflections of the THz pulses from the top and bottom surfaces cancel each other out. The defect signature is only weakly detectable compared to when the spacing is greater than the minimum THz wavelength (approx. 50-150 microns), the shearographic loading will microscopically deform defects, changing the small THz reflections in the loaded vs. unloaded state. The differential images should subtract all background clutter and highlight the microscopic subsurface distortion of the defects under loading.

Primary U.S. Work Locations and Key Partners




NASA SBIR/STTR Technologies
Proposal No. H13.02-7099 Non-Destructive Evaluation/NDE Sensors:
Differential Terahertz Imaging Methods for
Enhanced Detection of Subsurface Features, Flaws, and Damage
PI: David Zimdars, Picometrix LLC, Ann Arbor, MI
Identification and Significance of Innovation
Phase I TRL Start 2, End 4
Phase I Technical Objectives and Work Plan
NASA and Non-NASA Applications
Firm Contacts
NON-PROPRIETARY DATA

Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase I

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Completed Technology Project (2016 - 2016)

Organizations Performing Work	Role	Type	Location
Picometrix, LLC	Lead Organization	Industry	Ann Arbor, Michigan
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Michigan	Virginia

Project Transitions

June 2016: Project Start

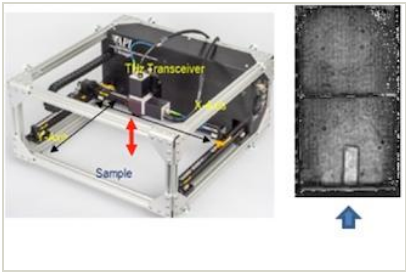
December 2016: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140422)*

Images

Briefing Chart Image
Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase I *(https://techport.nasa.gov/image/130934)*



Final Summary Chart Image
Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase I Project Image *(https://techport.nasa.gov/image/125907)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Picometrix, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

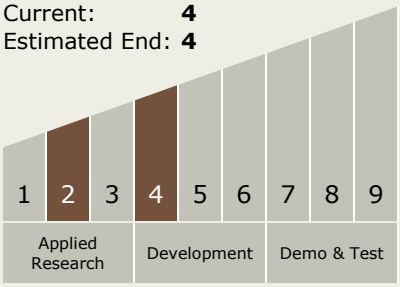
Carlos Torrez

Principal Investigator:

David Zimdars

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System